

New Capabilities & Instrumentation

Computer Cluster

A 100-node computer cluster has been installed featuring modern architecture (8CPU/32Gb memory per node) and utilizing fast interconnect technology for parallel computations. The new cluster allow us to increase our computational power by a factor of 10, memory capacity by a factor of 5, and storage capacity by a factor of 10. Furthermore, fast interconnect capabilities will make it possible to run medium/large scalecomputational tasks in parallel. (Contact Sergei Tretiak)

Near-IR fluorescence imaging and spectroscopy

This system offers both single-line laser and broad wavelength-selectable lamp excitation for fluorescence and photoluminescence excitation spectroscopy on solution and solid bulk samples. The spectroscopy is integrated to a microscope, which allows confocal fluorescence imaging and spectroscopy on single nanostructures. The microscope is paired with a 2-D InGaAs imaging array to allow wide-area direct imaging of individual nanostructures and assemblies in real-time. (Contact Steve Doorn)

Multi-Photon Laser Scanning Confocal and Fluorescence Lifetime Imaging Microscope

This instrument consists of Multi-Photon Laser Scanning Confocal Microscope (Olympus FV1000) with a Fluorescence Lifetime Imaging Attachment (Lambert Instruments). It is among the most advanced, commercially available optical imaging systems, and gives CINT a world-class capability for optical characterization of any array of biological, synthetic, and hybrid nanomaterials. Techniques enabled by this system include Fluorescence Recovery After Photobleaching (FRAP), Fluorescence Resonance Energy Transfer (FRET), Total Internal Reflectance Fluorescence (TIRF). The FLIA module will enable spatial mapping of fluorescence lifetimes. (Contact Gabriel Montano)

IR Variable angle spectral ellipsometer

An infrared variable angle spectral ellipsometer has been installed at the core CINT facility. The instrument is an IR-VASE from J.A. Woollam and covers a spectral range from 2 to 40 μ m. The instrument allows optical characterization of thin films and substrates in this spectral range, for example refractive index (n) and extinction (k) coefficients. These experimentally determined optical parameters can then be used for the design of complex optical devices such as metamaterials, dielectric stacks, etc. (Contact Igal Brener)

AFM Imaging

An Asylum MFP-3D-SA AFM system allows for both standard and user-defined operation modes. A specific application focus of this new AFM is imaging and spectroscopic force measurements of dynamic biological and biomimetic assemblies and structure formation. (Contact Gabriel Montano)



High-Resolution X-Ray Diffraction System

The XRD instrument is comprised of a high-precision XRD platform with small-angle x-ray scattering, and variable temperature/pressure, thin-film, and microdiffraction accessories. It is capable of variable-temperature and pressure crystal phase identification and quantification; size, size-distribution and shape analysis of nanocrystals and crystalline domains; film thickness in single and multilayer films together with core and shell thickness determination in heterogeneous core/shell nanocrystals; stress analysis in films and heterogeneous nanomaterials; and quality control of epitaxial films and superlattices. (Contact John Reno)

Atomic Layer Deposition System

This state-of-the-art atomic layer deposition (ALD) system, housed in our Integration Lab, utilizes precursor gases with single atomic layer control to enable conformal coating for nanoscale structure integration. ALD offers a unique means for the conformal deposition of dielectric and metallic films on 3-dimensional nanostructures with single atomic layer control. (Contact John Nogan)

DC Sputtering/Thermal Evaporation System

The new AJA International, Inc. ATC Orion Series Combination DC Sputtering/Thermal Evaporation System provides ease-of-use and operating flexibility. The magnetron sputtering sources feature a modular magnet array that allows operation in a variety of modes depending on our particular application for a specific film deposition run. The system also allows for “confocal sputtering,” which provides rapid sputtering of high quality and uniformly thick metal films ($\pm 2.5\%$ thickness uniformity over 4” diameter substrates). The unique isolation chimney prevents cross-contamination of target materials and allows deposition profiles to be fine-tuned, allowing sequential deposition of a series of metals (2-4) in single runs (without breaking vacuum). (Contact Jennifer Hollingsworth)

Low-Pressure Chemical Vapor Deposition

A low pressure chemical vapor deposition (LPCVD) / diffusion furnace has been installed in our Integration Lab for deposition of high quality low stress films including LPCVD SiN, thermal SiO₂, LPCVD SiO₂, and LPCVD Poly-Si layers for electrical isolation and for mechanical support. Mechanical support allows for high density films (e.g. low imperfections) without significant stresses. For micro-electromechanical systems (MEMS) and nano-electromechanical systems (NEMS) the ability to tailor the stress is key as stress and stress gradients are dominant mechanisms that induce device failure. (Contact John Nogan)

Ultrafast Laser System for Rapid Prototyping

We have developed a turnkey, ultrafast laser system for rapid prototyping devices including 2D microfluidics and 3D waveguides in bulk media. The system can also perform multi-photon processing of polymers, surface texturing, and patterning of arbitrary 2D array structures, such as thin film metamaterials, onto a substrate. Feature sizes are user definable and currently range from hundreds of nanometers to <10 μ m. (Contact Quinn McCulloch)

Graphene Reactor

We have developed a large area graphene growth capability at CINT that allows us to make graphene samples available to CINT users. The graphene is grown on copper foil by a chemical vapor deposition process using either liquid or gas precursors. We have also developed the techniques to transfer the large pieces of graphene to virtually any substrate for further characterization. (Contact Andrew Dattelbaum)

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